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THE EXTENSION OF THE PRESENT LIMITS OF  
THE WESTERN YELLOW PINE OUT ON THE DESERT.

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Service.)

ANNUAL SILVICAL REPORT  
FREMONT NATIONAL FOREST  
1913.

The Extension of the Present Limits of the Western  
Yellow Pine Out on the Desert.

by  
NORMAN G. JACOBSON,  
Forest Assistant.

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1917.

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WILLIAM C. JACOBSON

Forest Assistant.

Univ. of  
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THE EXTENSION OF THE PRESENT LIMITS OF  
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The question of the extension of the natural forest out into the open plains has been before the forester for many years, and today nearly every man who has given the subject some study is quite certain in his own mind that he knows the fundamental reasons for the lack of natural forest on the plains.

Experimental work in the planting on treeless areas has already proven that the present plant formation or vegetation on the ground does not mark the true boundary between the different plant zones, and that a complete analysis of the habitat, or in other words - all the forces and factors that have any bearing on plant life must be summed up for each area before its true formation or type can be determined. It will, therefore, be seen that a thorough knowledge of the history and conditions of each region, the silvical characterization of the species dealt with and the peculiarities of each area are essential before one can state whether a certain area has any commercial or potential forest value.

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The northern and eastern part of the  
Fremont National Forest is in the northwest and  
of the Great Basin region of interior drainage  
which lies between the Sierra Nevada and Rocky  
Mountains. The Walker and Paulina Mountains to  
the north and the southern portion of the Summer  
Lake Rim to the west form the divide between the  
Pacific and interior drainage basin in Oregon.  
This Great Basin was a high, apparently level,  
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The northern and eastern part of the Fremont National Forest is in the northwest end of the Great Basin region of interior drainage which lies between the Sierra Nevada and Rocky Mountains. The Walker and Piute Mountains to the north and the southern portion of the Summer Lake Rim to the west form the divide between the Pacific and interior drainage basin in Oregon. This Great Basin was a high, apparently level, lake bed with an elevation ranging between 4500 and 7100 feet above sea level. During the Pliocene epoch, at the period when the Cascade and Sierra Nevada Mountains were uplifted, this pre-existing plateau was broken up into irregular blocks, some of which dropped and others were dipped or tilted - thus forming escarpments or faults

with a general trend north and south, such as the Summer Lake Rim, Warner Mountains and Rim and in fact nearly all the irregularities in the topography of this country. Recent formations such as volcanic cones, fragmental material forming rock flats or "Devil's Garden" resulting from lava flows are quite common in this region, but this latter factor, other than giving more or less variety to the topography, has had but little to do with the shaping of the general features of this country. Large inland lakes followed this period of deformation and these lakes have as a result gradually filled up with sediments from the adjoining hills and have formed the large flats or plains now forming the sagebrush desert or dry farming lands of this region. Summer, Abert, Christmas and probably Goose Lakes are remnants of these large inland lakes. All of these lakes are now very shallow, none of them being over 25 feet deep in any place. The water of Abert, Summer and Christmas Lakes contains salts of commercial value.

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## CLIMATE.

East of the Cascade Mountains the effects of ocean currents are lost and the climate, with the exception of scanty rainfall, is similar to that of Iowa, Illinois and Ohio, or regions of the same latitude. The summers are long with hot days, especially in the large open flats or plains, and cool frosty nights. Stormy seasons begin in October, with winter weather during the months of January, February and March and end up in May. Weather records have been kept at Lakeview off and on for a number of years, as well as at Silver Lake. These show a maximum and minimum temperature of 102 degrees F. and 30 degrees F. below zero, the two extremes being a trifle greater at Silver Lake. Precipitation is not only variable in quantity from year to year but has a great many local variations. Detailed records are not available for any particular region except Lakeview and Silver Lake. The records of these two localities show annual fluctuations in amounts varying from 8 inches to 27 inches per annum, with an average of about 17 inches per year in Lakeview and 11 inches at Silver Lake.

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The present vegetation, psychrometer readings and snowfall prove that humidity increases very materially with elevation; even slight elevations such as low rolling isolated hills show a marked difference. It is a question whether the aspect makes any particular difference in the amount of precipitation. The vegetation on the ground shows, however, that there is more available moisture on the north and east slopes. The south and southwest slopes are usually more open in the timbered sections and as one approaches the desert - the hills are always barren on the south and west slopes. The prevailing winds are from the north west and south, the southern winds being the rain bearers and not the rule during the months of July, August and September. During these three months, local winds, miniature cyclones and thunder showers over small areas are the rule.

Due to the character of the rock and unfavorable condition for decay, the process of soil formation has necessarily been very slow in this region and confined to physical rather than chemical forces. The soil is, therefore, very shallow except at the lower elevations and points, where it has been deposited by water and winds. Where the

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soil has piled up to sufficient depth so as to form a blanket dense enough to retard evaporation, the ground becomes saturated with water below a certain point. The depth of this water line depends entirely upon the rainfall and seepage, or inflow by sub-irrigation. Instead of a level line, this water line follows the topography of the country to a certain extent, being a little further from the surface on the hills and closer to the surface in the valleys. Well water can be obtained in practically all the valleys at depths ranging from 6 to 90 feet. Natural sub-irrigation and the location of this water line is in many cases the factor which determines the present vegetation on the ground. Slopes of the same aspect and pitch and in the same locality may in some cases have a different cover, due entirely to the water content of the soil. Such cases are in evidence especially along the eastern border of the Forest.

#### FOREST FIRES.

The effect of forest fires is a prominent factor in practically all forest regions and doubly so in this semi-arid region. Statistics on recent fires set by lightning, and evidences of fire damage in all parts of the forest, show that fires have been a constant enemy of the forest since time immemorial.

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Old residents and the pioneers of this region maintain that the Indians annually set out fires in order to improve their hunting grounds and to stimulate the bunch grass on the flats so as to make better feed for their ponies. Whether the Indians who roamed over this region centuries before white man ever saw it did any such systematic burning, is questionable, but if they did, it is quite certain that the fires would be set at the lower elevations in the plains where the bunch grass grew the best. It has been proven by the Sears Flat fire of 1910 that such burning would drive the frontier boundary of the Forest back very materially. Sage brush, mixed with dead bunch grass, burns like a blanket of oil and even a surface fire in a forest where the principal underbrush is sagebrush will kill all reproduction and saplings and a large share of the mature trees in its path. Due to the speed that a fire travels and the great heat produced, top fires in ~~si~~ isolated trees whose branches are at least 40 feet from the ground have been known to occur. All old residents, especially cowmen - and they were the pioneers in the stock business - contend that overgrazing has depleted the bunch grass on the plains and that areas now covered with a sparse stand of

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sagebrush were at one time covered with waving bunch grass, several feet in height. If such is the case, and whether fires were set out by the Indians or caused by lightning, fire would undoubtedly sweep over the country and kill all forms of vegetation in its path.

The region south of Silver Lake Post Office, including the north west slope of Hager Mountains in Township 29 S., Range 14 E., W. M., appears to be a typical example of such a case. Here a fire about 100 to 120 years ago has left a trail that shows that it started somewhere in the flat at the base of the mountains and killed everything in its path, leaving only small patches or islands of mature trees. This slope of the mountains is now covered with a practically even-aged stand of yellow pine, averaging about 90 years in age.

The boundary of the natural forest, or its frontier line, is very irregular and has innumerable fringes here, but the tall clean boles of the mature trees along the border and uneven-aged reproduction extending out scatteringly even as far as a mile from the seed trees tend to show that a much heavier stand at one time occupied the same ground and will gradually gain its ground back again

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## SILVICAL CHARACTERISTICS OF WESTERN YELLOW PINE.

### 1. Habit.

The Western Yellow Pine is a rough-barked massive tree with a rather open conical crown. At maturity, heavy branches and a round crown are developed. Trees grown in the open are short, with wide spreading branches. It has a deep spreading root system, and in some cases develops a pronounced tap root.

### 2. Occurrence:

It is found in both pure and mixed stands, and natural stand being pure at the lower elevation and mixed with white fir, sugar and white pine at the higher and more moist elevations.

### 3. Soil and Moisture Requirements.

All of the soil of this region is of volcanic origin and is quite similar. No real pumice soil is found on the Fremont. Soil moisture is, however, probably the most important factor in limiting its occurrence and in a large measure controls the density of the present stand in this region. Competition with other more tolerant species prevents the establishment of Yellow Pine in the moist and favorable locations. It has through necessity, there-

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fore, developed great ability for thriving in dry soils.

#### 4. Tolerance.

The Yellow Pine is less tolerant of shade than any of its associates, mature trees requiring almost pure unbroken light. Like most forest trees, the young growing Western Yellow Pine trees are more tolerant than older trees and the amount of available moisture in the soil determines to a large measure the density of the stand even when a large percent of the trees are mature. The open sparser stands of Western Yellow Pine found on the lower dry slopes is not, therefore, due to the lack of light but to the lack of moisture. Young reproduction is quite tolerant and very dense stands are quite common in moist locations, but after a height of 10 feet has been reached the stand thins out very rapidly. Seedlings require some shade for several years until they have established a firm deep root system and then they can stand and make more volume growth when they are subject to the direct rays of the Sun.

#### 5. Growth and Longevity.

The rate of growth of Western Yellow Pine depends entirely upon the quality of the locality. Seedlings in dry localities may not make over 2 to

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Seedlings in dry localities may not make over 2 to

3 inches in height growth per year, while others on more moist slopes make from 6 to 12 inches per year. All seedlings, however, make very slow growth for the first three years until a deep and firm root system is established.

Counts of annual rings show that the average tree is very slow in making diameter growth until it is 50 or more years old, the average diameter of 50 year old trees being less than 7 inches. Another significant fact that has been observed in counting the annual rings of Western Yellow Pine stumps is that trees grown in the open, even at low elevations, make a faster diameter growth all through their natural life than trees found in average stands on the higher and apparently more moist slopes. This increase in growth is also very pronounced in seedlings. By analyzing seedlings grown three-quarters of a mile from the edge of a treeless area, in a stand averaging 9 H. feet B. M., 350 seedlings and 30 saplings per acre, it was found that at an average age of 19 years the seedlings were 1.57 inches in diameter at the ground and 5.25 feet in height. Seedlings grown on the border of a forest in a stand averaging 3 H. feet B. M. and 400 seedlings per acre showed that at an

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average age of 15 years the seedlings were 1.27 inches in diameter and 3.87 feet high, while isolated seedlings grown in the sagebrush one-half to one mile from the edge of the border forest showed that at an average age of 15 years the seedlings were 1.36 inches in diameter and 5.54 feet in height. These figures show very strikingly the relation of moisture to growth of Yellow Pine in this region. The amount of available moisture due to elevation is greater in the case of the first seedlings, while that of the seedlings grown on the edge of the Forest and those isolated ones grown in the sagebrush is probably about the same - and since there are more trees to use the moisture on the edge of the forest than in the sagebrush, there is not as much available for each individual tree and consequently it does not make as rapid growth.

The tree is rather long lived, the average age of maturity being about 350 years. The largest and oldest tree analyzed up to the present time on this Forest was 455 years old, 125 feet high, 54 inches in diameter at breast height and scaled 6630 feet B. M. by the Scribner, Decimal C log scale. The maximum diameter recorded on the

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Fremont is 84 inches D.B.H.      ally do not scatter

6. Reproduction.      therefore, do a great deal more

The Western Yellow Pine is a very prolific seeder, especially trees grown in the open and along the edge of the desert. Some seed is produced locally every year. Heavy seed crops throughout the forest occur every 4 or 5 years, except that on trees along the edge of the forest no seed is borne on trees younger than 125 years. The cones are quite persistent, remaining on the tree for practically a year after maturity so that all the seed is disseminated before the cones fall to the ground. Wind is the chief agent in distribution of the seed. Yellow Pine seed, evidently carried by wind, has been found 250 yards from any seed tree. Chipmunks and squirrels distribute considerable seed in the forest, but do not aid any in the extension of the natural forest out in the openings. Contrary to conditions in the pumice soil country, the squirrels do not bury small parcels of 50 to 100 seeds in the soil but instead store their food supplies in decayed stumps and rocks and in many cases carry the whole cones and deposit them in springs or protected places in creeks so as to keep the cones closed until they are eaten.

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As a result the squirrels really do not scatter much seed and, therefore, do a great deal more damage than good.

The seed that has been disseminated during the late fall and early winter months usually germinates early the next spring. It is essential, however, that the seeds get into the mineral earth and that the necessary protection from excessive evaporation is afforded. The moisture resulting from the melting snows is usually enough to stimulate and start the germination of the seed. Life is then prolonged by the plant foods stored in the seed, while a primary root several inches long is pushed into the moist soil and develops secondary roots upon reaching available moisture. Then several tightly-rolled pointed leaves push out of the ground and carry the seed coat with them on their tips. After the primary root is formed and the leaves begin to extend above the surface of the ground, its life depends upon whether the primary root is well enough established to keep pace with the immediate drought that usually follows. It is for this reason that the largest percentage of Western Yellow Pine seedlings are found in sheltered places where the transpiration of

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moisture from the soil is held in check until the seedling has gained its foothold. This habit of Pine seedlings also explains why the greatest percentage of pine seedlings die immediately after the seed has germinated and that those seedlings which pull through this invalid stage and once gain a foothold usually pull through the drought period in fair shape in our experiments of planting pine seed by the seed spot method. Up to the present time no trouble by the heaving of soil like that in pumice soils has been observed in this country.

#### 7. Susceptibility to Injury.

Windfalls are quite common in some localities and usually occur in the spring of the year, immediately after the snow has melted and when the ground has thawed out. Lightning injures quite a number of trees each year but the greatest damage from this agent is caused by fire that in some cases results from the lightning stroke. Lightning is more destructive in certain localities, especially on the southwest slopes of the high ridges.

Porcupines do considerable damage to Western Yellow Pine by girdling the bark near the

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Forewings do considerable damage to Western Yellow Pine by attacking the bark near the

tops of thrifty saplings in the natural forest and girdling the bark completely around the stem and limbs of 3 to 5 foot seedlings that grow in the open. Out of 70 seedlings counted that were at a distance ranging from one-quarter to one mile from the natural forest boundary south of Silver Lake, Oregon, 42 seedlings had been completely girdled so that death was inevitable, and 13 others were partially girdled. Only 15 had not been molested. This work had been done during the winter of 1911-1912. From this it can be readily seen that the porcupine is a serious pest in the Yellow Pine forest and since they usually remain on the edge of the forest in the winter time, they are a very important agent in retarding the extension of the present limits of the forest. Stock grazing assists very materially in the extension of the present limits of the Western Yellow Pine forest by keeping the bunch grass in check and thus removing one of the most active competitors for soil moisture - and in this way preventing the establishment of seedlings.

Bark beetles do some damage throughout the entire Western Yellow Pine forest, but since the percentage of insect-killed trees are not

tops of thirty seedlings in the natural forest and girdling the bark completely around the stem and limbs of 5 to 8 foot seedlings that grow in the open. Out of 70 seedlings counted that were at a distance ranging from one-quarter to one mile from the natural forest boundary south of Silver Lake, Oregon, 42 seedlings had been completely girdled so that death was inevitable, and 15 others were partially girdled. Only 13 had not been molested. This work had been done during the winter of 1911-1912. From this it can be readily seen that the porcupine is a serious pest in the Yellow Pine forest and since they usually remain on the edge of the forest in the winter time, they are a very important agent in retarding the extension of the present limits of the forest. Stock grazing assists very materially in the extension of the present limits of the Western Yellow Pine forest by keeping the bunch grass in check and thus removing one of the most active competitors for soil moisture - and in this way preventing the establishment of seedlings.

Bark beetles do some damage throughout the entire Western Yellow Pine forest, but since the percentage of insect-killed trees are not

greater along the border forest than other parts of the forest it can only be considered as an enemy of the species.

#### 8. Associated Species.

Western Juniper is the only tree that is found associated with Western Yellow Pine on the border, and this tree - due to its slow growth, intolerance and ability to grow in dry rocky soil - does not compete with the Western Yellow Pine, but rather prepares the ground for it. Because of its open stand, slow growth and uncertain reproduction, its chief value is for preventing erosion of the soil on the steep slopes and affording slight protection to Yellow Pine seedlings.

#### 9. Local History.

For a full understanding of the factors and conditions which have a bearing on the extension, either natural or artificial, of the Western Yellow Pine forest out from its present limits, the history of what the past has been is absolutely essential. Although records and detailed information are very meagre and cover only several spots in an area over 100 miles square, this data shows that sudden and radical changes in rainfall are quite common in this region. Local history of this region

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-17-

partially and sufficient allowance must be made for  
tells us that Silver Lake, which now covers an area  
of approximately 70 square miles, was dried up during  
the years of 1898 and 1899 and crops of oats 7 feet  
high were raised on land now inundated by from 3 to  
10 feet of water. Precipitation records show also  
that there were very few dry years. In the early fifties,  
immigrants made a well-defined trail which is  
yet visible in places across a point in Goose Lake  
now covered with 10 feet of water. For a short period  
in 1869 the lake overflowed into Pitt River. The solution  
of these two facts is that the lake level fluctuated  
23 feet in about 15 years. The level of the lake  
at the present time is about 13 feet below the Pitt  
River outlet. Weather records taken at Silver Lake and  
Lakeview have no particular value except for comparison.  
Observation of the amount of snowfall at various elevations  
and different localities show that the data from the two  
stations, both of which are over 8 miles from the natural  
forest and 100 miles apart, cannot be used even to give a  
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tells us that Silver Lake, which now covers an area of approximately 70 square miles, was dried up during the years of 1898 and 1899 and crops of oats 7 feet high were raised on land now inundated by from 5 to 10 feet of water. Precipitation records show also that there were very few dry years. In the early fifties, immigrants made a well-defined trail which is yet visible in places across a point in Goose Lake now covered with 10 feet of water. For a short period in 1899 the lake overflowed into Pitt River. The relation of these two facts is that the lake level fluctuated 25 feet in about 15 years. The level of the lake at the present time is about 15 feet below the Pitt River outlet. Weather records taken at Silver Lake and Lakeview have no particular value except for comparison. Observation of the amount of snowfall at various elevations and different localities show that the data from the two stations, both of which are over 6 miles from the natural forest and 100 miles apart, cannot be used even to give a general idea of the country and much less for the determination of the habitat of any particular area, except where the readings have been made. These figures show, however, that occasional well tests and psychrometer readings have no particular value and that small areas must be determined as-

parately and sufficient allowance must be made for the occasional dry years that are certain to come.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	T
1	1.03	2.74	1.04	0.34	X	X	X	X	X	X	1.48	1.51	
2	0.82	3.00	0.77	1.46	2.05	2.24	1.03	X	X	X	X	T	
3	0.13	0.91	2.40	0.77	2.52	X	X	X	X	X	1.50	1.46	
4	1.50	0.75	1.09	0.95	X	X	X	X	X	X	X	X	
5	X	X	X	X	X	0.82	X	X	X	X	X	X	
6	X	X	X	1.89	0.64	0.30	0.13	0.39	0.18	0.49	2.32	X	
7	X	X	X	X	X	X	X	X	X	X	X	X	
8	0.25	X	0.80	0.25	1.91	2.65	0.07	0.00	0.39	0.23	0.13	1.47	
9	0.27	0.30	0.15	0.22	1.81	0.76	0.20	0.05	0.20	0.50	2.03	0.58	
10	1.40	0.24	1.27	0.11	0.49	T	T	0.40	0.37	1.33	1.74	1.42	
11	0.80	T	0.31	0.42	0.85	0.42	T	0.45	0.40	2.08	0.35	0.85	
12	1.17	1.53	0.23	0.10	0.34	0.04	0.22	0.40	1.09	1.31	0.57	0.22	
13	0.20	1.17	0.15	1.67	0.62	X	X	X	X	X	X	X	
14	1.73	0.55	1.15	X	0.52	0.72	X	X	X	X	X	X	
15	X	X	X	1.85	0.55	0.03	1.60	T	T	0.36	0.55	X	
16	X	0.82	1.09	0.97	2.20	2.23	0.06	T	1.75	0.35	0.23	0.22	
17	1.73	0.55	1.64	0.38	2.14	1.08	0.64	0.78	X	0.60	T	1.55	
18	1.11	2.04	1.71	0.53	2.25	0.89	0.41	1.13	0.42	0.77	0.38	0.43	
19	T	0.09	0.23	0.87	0.87	2.08	0.30	X	X	X	X	X	
20	2.50	0.88	1.07	0.10	0.44	1.38	0.43	T	0.84	0.65	X	X	
21	X	X	X	X	X	X	X	X	X	X	X	X	
22	T	X	T	1.21	0.82	1.04	0.16	T	1.51	0.43	0.70	0.43	
23	0.92	0.22	0.83	1.34	1.44	1.97	0.76	1.45	0.46	0.22	0.88	1.28	

X - No record available. T - Trace.

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The average yield of the crop is about 100 bushels  
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# WEATHER REPORT - SILVER LAKE, ORE.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1890	1.03	2.74	1.04	0.34	X	X	X	X	X	X	1.48	1.31	
1891	0.62	3.08	0.77	1.46	2.65	2.24	1.63	X	X	X	X	T	
1892	0.12	0.91	2.40	0.77	2.52	X	X	X	X	X	1.50	1.46	
1893	1.50	0.75	1.09	0.93	X	X	X	X	X	X	X	X	
1894	X	X	X	X	X	0.82	X	X	X	X	2.32	X	
1895	X	X	X	1.89	0.64	0.30	0.13	0.39	0.18	0.49	X	X	
1896	X	X	X	X	X	X	X	X	X	X	0.13	1.47	
1897	0.25	X	0.80	0.25	1.91	2.65	0.07	0.00	0.39	0.23	0.13	1.47	6.99
1898	0.27	0.30	0.15	0.22	1.81	0.76	0.20	0.05	0.20	0.56	2.03	0.38	9.09
1899	1.40	0.24	1.27	0.17	0.49	T	T	0.40	0.37	1.33	1.74	1.48	7.10
1900	0.80	T	0.31	0.52	0.85	0.42	T	0.45	0.49	2.08	0.35	0.83	7.29
1901	1.17	1.58	0.25	0.10	0.34	0.04	0.22	0.40	1.09	1.31	0.57	0.22	
1902	0.20	1.17	0.18	1.67	0.62	X	X	X	X	X	X	X	
1903	1.73	0.55	1.15	X	0.52	0.72	X	X	X	X	0.56	0.55	
1904	X	X	X	1.86	0.65	0.03	1.60	T	T	0.56	0.55	0.23	0.22
1905	X	0.82	1.69	0.97	2.20	2.23	0.06	T	1.75	0.55	0.23	0.22	
1906	1.76	0.55	1.64	0.38	2.14	1.08	0.64	0.78	X	0.69	T	1.56	
1907	1.11	2.04	1.71	0.52	2.25	0.89	0.41	1.13	0.42	0.77	0.38	0.48	12.1
1908	T	0.09	0.23	0.87	0.87	2.08	0.80	X	X	X	X	X	
1909	2.90	0.88	1.07	0.10	0.44	1.38	0.43	T	0.84	0.65	X	X	
1910	X	X	X	X	X	X	X	X	X	X	X	X	
1911	X	X	T	1.21	0.82	1.04	0.16	T	1.51	0.43	0.70	0.43	
1912	0.92	0.22	0.83	1.34	1.44	1.97	0.76	1.45	0.46	0.22	0.88	1.28	11.7

X - No record available.

T - Trace.

# WEATHER REPORT - SILVERDALE, ORE.

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1890	1.02	2.74	1.04	0.34	X	X	X	X	X	X	1.48	1.31
1891	0.62	3.08	0.77	1.46	2.62	2.84	1.63	X	X	X	1.50	1.66
1892	0.22	0.91	2.40	0.77	2.52	X	X	X	X	X	X	X
1893	1.20	0.75	1.09	0.95	X	0.82	X	0.39	0.18	0.49	2.32	X
1894	X	X	X	1.89	0.64	0.30	0.13	X	X	X	X	X
1895	X	X	X	X	X	X	X	0.00	0.39	0.23	0.13	1.27
1896	X	X	0.80	0.25	1.91	2.62	0.07	0.02	0.20	0.58	0.38	6.29
1897	0.25	X	0.30	0.15	0.22	0.76	0.20	0.02	0.20	0.58	0.38	6.29
1898	0.27	0.30	0.15	0.22	1.81	0.76	0.20	0.02	0.20	0.58	0.38	6.29
1899	1.40	0.24	1.27	0.17	0.49	T	0.45	0.45	0.49	2.08	0.82	7.10
1900	0.80	T	0.51	0.75	0.82	0.45	0.25	0.40	1.09	1.31	0.33	7.22
1901	1.17	1.58	0.52	0.10	0.34	0.04	0.25	X	X	X	X	X
1902	0.20	1.17	0.18	1.67	0.62	X	X	X	X	X	X	X
1903	0.20	1.17	0.18	1.67	0.62	X	X	X	X	X	X	X
1904	1.73	0.75	1.15	X	0.75	0.03	1.60	T	1.75	0.55	0.55	1.56
1905	X	X	X	1.88	0.33	0.33	0.06	0.78	X	0.69	0.38	12.11
1906	X	0.82	1.69	0.97	2.77	2.08	0.64	0.41	0.45	0.77	0.38	12.11
1907	1.76	0.82	1.64	0.38	2.77	2.08	0.64	0.41	0.45	0.77	0.38	12.11
1908	2.04	1.71	0.71	0.72	2.77	2.08	0.64	0.41	0.45	0.77	0.38	12.11
1909	0.09	0.83	0.87	0.87	2.08	0.80	0.45	X	X	X	X	X
1910	2.90	0.88	1.07	0.10	0.44	1.38	0.45	X	X	X	X	X
1911	X	X	X	X	X	X	X	X	X	X	X	X
1912	0.92	0.92	0.92	1.34	1.34	1.34	0.76	1.45	0.66	0.52	0.68	11.77

X - No record available. T - Trace.

# CONCLUSION.

Whereas there is an intermediate type of

## WEATHER RECORDS - LAKEVIEW, ORE.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1890	X	X	X	X	X	0.23	0.00	T	2.29	0.12	T	1.00	24.5
1891	0.49	4.95	2.06	1.09	3.69	2.97	0.90	0.15	0.38	0.42	1.07	6.38	19.5
1892	2.01	1.57	1.27	2.18	2.04	0.67	0.08	T	1.51	1.99	3.78	2.47	19.5
1893	1.89	2.97	1.74	2.44	X	0.07	0.31	0.00	1.19	1.59	3.68	1.65	
1894	4.66	4.92	3.18	0.58	2.24	X	X	X	X	X	0.97	3.45	
1895	5.15	1.02	2.00	0.52	1.33	T	0.20	0.45	0.60	T	1.10	2.25	14.6
1896	3.55	1.00	2.32	3.94	2.21	0.10	0.50	0.51	1.17	0.60	2.96	1.45	17.3
1897	1.13	2.95	3.13	1.03	0.92	2.09	0.10	0.10	0.86	0.36	1.78	1.68	16.1
1898	1.40	1.08	0.10	0.05	1.74	0.24	0.08	T	T	0.95	1.25	1.50	8.3
1899	X	0.80	2.25	1.18	1.10	0.20	T	0.50	0.00	2.60	2.15	2.43	
1900	1.44	1.71	1.04	1.38	X	X	X	X	X	X	X	1.03	
1901	3.01	2.53	0.59	1.07	0.69	T	0.00	0.27	1.09	1.29	1.73	2.78	15.1
1902	0.83	3.32	1.41	2.28	2.22	0.10	0.45	0.18	0.21	1.17	2.20	2.38	16.7
1903	3.59	1.14	1.93	0.48	0.53	1.23	0.46	0.32	0.06	0.44	4.94	0.99	16.1
1904	1.41	5.45	4.53	2.76	0.27	0.59	0.43	0.03	1.10	1.43	0.20	3.27	21.4
1905	1.67	0.73	2.47	0.44	1.41	0.70	0.00	0.07	0.50	0.22	0.63	1.08	9.9
1906	4.63	1.59	3.14	0.53	1.88	1.21	0.20	0.00	0.82	0.47	1.52	3.72	19.7
1907	3.39	4.53	3.79	0.22	1.40	2.76	0.27	1.74	2.29	2.85	1.09	2.83	27.0
1908	0.57	0.85	0.30	0.00	1.75	X	X	0.00	X	X	X	1.10	
1909	7.56	X	X	X	0.85	0.13	0.05	0.10	X	X	X	1.24	
1910	1.26	2.30	0.00	0.00	0.10	0.01	0.00	0.04	X	X	X	1.11	
1911	X	X	X	X	X	X	X	X	X	X	X	1.11	
1912	2.14	1.50	1.35	0.91	0.23	0.84	0.42	0.88	0.43	0.12	1.62	0.89	12.3

X - No records obtainable.

T - Trace.

to the density. In other words, a dense stand would mean a more rapid growth of individual trees. A very rough estimate of the growth for the Connally Hills and open ground south of the Silver Lake Post Office, which was covered with timber and sagebrush,

X - No records obtainable. ? - trace.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
90	X	X	X	X	X	X	X	X	X	X	X	X
91	0.49	4.95	2.06	1.09	2.69	2.97	0.90	0.12	0.38	0.42	1.07	6.39
92	2.01	1.27	1.27	2.18	2.04	0.67	0.08	T	1.21	1.22	2.78	2.47
93	1.89	2.97	1.74	2.44	X	0.07	0.21	0.00	1.19	1.22	3.88	1.62
94	4.66	4.92	2.18	0.28	2.24	X	X	X	X	X	0.97	2.42
95	2.12	1.02	2.00	0.22	1.32	T	0.20	0.42	0.60	T	1.10	2.22
96	2.22	1.00	2.22	2.22	2.21	0.10	0.20	0.21	1.12	0.60	2.96	1.42
97	1.12	2.92	2.12	1.02	0.22	2.02	0.10	0.10	0.82	0.26	1.78	1.60
98	1.40	1.08	0.10	0.02	1.74	0.24	0.08	T	T	0.92	1.22	1.40
99	X	0.80	2.22	1.18	1.10	0.20	T	0.20	0.00	2.60	2.12	2.42
00	1.44	1.71	1.04	1.28	X	X	X	X	X	X	X	1.02
01	2.01	2.29	0.29	1.07	0.69	T	0.00	0.22	1.02	1.29	1.72	2.78
02	0.82	2.22	2.41	2.22	2.22	0.10	0.42	0.18	0.21	1.12	2.29	2.38
03	2.29	1.14	1.22	0.18	0.22	1.22	0.42	0.22	0.00	0.44	4.24	0.24
04	1.41	2.42	4.22	2.72	0.22	0.22	0.42	0.02	1.10	1.42	0.20	2.27
05	1.62	0.22	2.42	1.41	0.70	0.00	0.02	0.20	0.20	0.22	0.62	4.08
06	4.62	1.22	2.14	0.22	1.22	0.20	0.00	0.00	0.82	0.42	1.22	2.22
07	2.22	4.22	2.72	0.22	1.40	2.76	0.22	1.74	2.22	2.92	1.02	2.62
08	0.22	0.20	0.20	1.72	X	X	0.00	X	X	X	X	1.10
09	2.22	X	X	0.22	0.18	0.02	0.10	X	X	X	X	1.24
10	1.22	2.20	0.00	0.10	0.01	0.00	0.04	X	X	X	X	1.11
11	X	X	X	X	X	X	X	X	X	X	X	0.60
12	2.14	1.20	1.22	0.22	0.84	0.42	0.88	0.42	0.12	1.62	X	X

WEATHER RECORDS - LAKEVIEW, ORE.

## CONCLUSION.

Whereas there is no intermediate type of stunted trees between the forest and the sagebrush and there are actual examples of trees migrating out from the forest, it is quite certain that the present limits of the forest can be extended and will, in the most favorable places, do so naturally. The most important point at the present time, however, is whether the final product of normal stands will be large enough to make artificial planting or even protection practicable. It has already been proven that a forest takes more moisture from the soil than is evaporated from the same ground when absolutely bare, and since the volume of the stand would depend on the available moisture in the ground, and the soil at lower elevations receives less rainfall than those at higher elevations, the stand necessarily would be sparse and the rate of growth in ratio to the density. In other words, a dense stand would mean slow growth of individual trees while a sparse stand would mean a more rapid growth of the individual trees. A very rough estimate of the normal stand for the Connelly Hills and open country south of the Silver Lake Post Office, which areas are now covered with Juniper and sagebrush,

## CONCLUSION.

Whereas there is no intermediate type of  
stratified forest between the forest and the aspen  
and there are actual examples of trees migrating  
out from the forest, it is quite certain that the  
present limits of the forest can be extended and  
will, in the most favorable places, do so naturally.  
The most important point at the present time, how-  
ever, is whether the final product of normal stand-  
ing will be large enough to make artificial planting or  
even protection practicable. It has already been  
proven that a forest takes more moisture from the  
soil than is evaporated from the same ground when  
absolutely bare, and since the volume of the stand  
would depend on the available moisture in the ground,  
and the soil at lower elevations receives less rain-  
fall than those at higher elevations, the stand ne-  
cessarily would be sparse and the rate of growth  
in ratio to the density. In other words, a dense  
stand would mean slow growth of individual trees  
while a sparse stand would mean a more rapid growth  
of the individual trees. A very rough estimate of  
the normal stand for the Connelly Hills and open  
country south of the Silver Lake Post Office, which  
areas are now covered with juniper and aspen,

is 8 M. feet B. M. per acre in 200 years, or an annual increment of 40 feet B. M. per acre.

With protection from forest fires and after the wholesale destruction of porcupines and other destructive rodents, natural afforestation will undoubtedly take place at a more rapid pace. Natural reproduction ranging from 1 to 50 seedlings per section is found in the Connelly Hills and the open sage brush land in the northern tier of sections in the Fremont National Forest, and since none of the seedlings or Western Yellow Pine trees seen on these areas are over 20 years old, a more rapid succession can be expected if some protection is afforded.

Very little of the afore-mentioned land is or ever will be suitable for agriculture owing to its rough and rocky character. Therefore, forest growth - even though sparse and of poor quality - is better than nothing.

NORMAN G. JACOBSON

Forest Assistant.

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WILLIAM G. JACOBSON

Forest Assistant.





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